CLAIMS

Therefore, having thus described the invention, at least the following is claimed:

1. A sensor, comprising:

a silicon substrate having a porous silicon region, wherein a front contact is disposed on a portion of the porous silicon region, wherein the contact resistance between the porous silicon region and the front contact is between about 10 ohms and 100 ohms, and wherein the resistivity is between about 0.01 ohm/centimeter squared (cm^2) and 1 ohm/cm^2.

2. The sensor of claim 1, further comprising a back contact attached to a backside of the silicon substrate.

3. The sensor of claim 2, wherein the back contact comprises a metal selected from aluminum, nickel, and gold.

4. The sensor of claim 1, wherein the front contact comprises a metal selected from gold, silver, and copper.

5. The sensor of claim 1, wherein the contact resistance is between about 20 ohms and 60 ohms.

6. The sensor of claim 1, wherein the sensor is operative to detect a gas.

7. The sensor of claim 1, wherein the sensor is operative to detect a liquid.

8. The sensor of claim 1, wherein the sensor is operative to detect a biomolecule.

9. The sensor of claim 1, wherein the sensor is operative to detect about between about 10 parts per million (ppm) to 100 ppm of hydrochloric acid at a bias of between about 1 millivolts and 10 millivolts.

10. The sensor of claim 1, wherein the sensor is operative to detect about between about 10 parts per million (ppm) to 100 ppm of ammonia at a bias of between about 1 millivolts and 10 millivolts.

11. The sensor of claim 1, wherein the sensor is operative to detect about between about 10 parts per million (ppm) to 100 ppm of nitric oxide at a bias of between about 1 millivolts and 10 millivolts.

12. The sensor of claim 1, wherein the porous silicon region includes a macroporous framework on which is superimposed a nanoporous layer.

13. The sensor of claim 12, wherein the macroporous framework includes pores approximately 1 to 2 μm wide by about 10 μm deep.

14. The sensor of claim 1, wherein the porous silicon region is coated with a metal selected from platinum, palladium, iridium, rhodium, vanadium, and ruthenium.

15. The sensor of claim 1, wherein the porous silicon region includes nanostructures disposed within the porous silicon framework.

16. A gas chromatograph, comprising:

a detector including a gas sensor that includes a silicon substrate having a porous silicon region, wherein a front contact is disposed on a portion of the porous silicon region, and wherein the contact resistance between the porous silicon region and the front contact is between about 10 ohms and 100 ohms.

17. A liquid chromatograph, comprising:

a detector including a gas sensor that includes a silicon substrate having a porous silicon region, wherein a front contact is disposed on a portion of the porous silicon region, and wherein the contact resistance between the porous silicon region and the front contact is between about 10 ohms and 100 ohms.

18. A method for fabricating a sensor, comprising:

providing a silicon substrate;

converting a first region of the silicon substrate into a porous silicon region;

forming a first front contact onto a first portion of the porous silicon region;

forming a second front contact onto a second portion of the porous silicon region, wherein a third portion of the porous silicon region is between the first front contact and the second front contact.

19. The method of claim 18, wherein converting a first region of the silicon substrate into a porous silicon region includes forming the porous silicon region by electrochemical etching the porous silicon in a solution comprising acetonitrile, hydrogen fluoride, and tetrabutylammonium perchlorate.

20. The method of claim 18, wherein converting a first region of the silicon substrate into a porous silicon region includes:

treating the porous silicon region with an aqueous hydrochloric acid solution; and

treating the porous silicon region with an alcohol.

21. The method of claim 18, wherein converting a first region of the silicon substrate into a porous silicon region includes:

treating the porous silicon region with an aqueous hydrochloric acid and alcohol solution.

22. The method of claim 18, wherein converting a first region of the silicon substrate into a porous silicon region includes:

treating the porous silicon region with a hydrazine solution to remove fluorides from the porous silicon.

23. The method of claim 18, wherein the first front contact and the second front contact are formed by:

introducing a metal ion-containing electroless solution;

illuminating the first portion of the porous silicon region and the second portion of the porous silicon region with a light source at wavelengths less than about 750 nanometers to cause photoluminescence of the first portion of the porous silicon region and the second portion of the porous silicon region; and

metallizing the first portion of the porous silicon region and the second portion of the porous silicon region, wherein photoluminescence is capable of causing reductive metallization of the first portion of the porous silicon region and the second portion of the porous silicon region with the metal of the metal ion-containing electroless solution.

24. The method of claim 18, wherein converting a first region of the silicon substrate into a porous silicon region includes forming a porous silicon region that has a macroporous framework on which is superimposed a nanoporous layer.

25. The method of claim 18, wherein the first front contact and the second front contact are formed by electron-beam evaporation.

26. The method of claim 18, wherein the contact resistance between the third porous silicon region and the first front contact and the second front contact is between about 10 ohms and 100 ohms, and wherein the resistivity is between about 0.01 ohm/centimeter squared (cm^2) and 1 ohm/cm^2.

27. A method for fabricating a sensor, comprising:

providing a silicon substrate;

disposing a SiN_x layer onto the top surface of the silicon substrate;

exposing a first region of the top surface of the silicon substrate by removing a portion of the SiN_x layer so that the SiN_x layer is divided into a first SiN_x region and a second SiN_x region, wherein the first region of the silicon substrate is exposed between the first SiN_x region and the second SiN_x region;

converting the first region of the silicon substrate into a porous silicon region that is disposed between the first SiN_x region and the second SiN_x region;

disposing a first front contact onto a first portion of the porous silicon region;

disposing a second front contact onto a second portion of the porous silicon region, wherein a third portion of the porous silicon region in between the first front contact and the second front contact.

28. The method of claim 27, wherein the first front contact comprises a metal selected from gold, silver, and copper.

29. The method of claim 27, further comprising:

disposing a back contact onto a back portion of the silicon substrate.

30. The method of claim 29, wherein the back contact comprises a metal selected from aluminum, nickel, and gold.